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(71) Applicant
John Lawrence Eldridge,
24 Turnpike Road, Cumnor Hill, Oxford OX2 9SQ

(72) Inventor
John Lawrence Eldridge

(74) Agent and/or Address for Service
Swann Elt & Company,
31 Beaumont Street, Oxford OX1 2NP

(54) Improvements in or relating to adjustable electrode mounts

(57) An adjustable electrode mount of the type which is carried by a three-axis manipulator and itself carries and positions an electrode for biological measurements. The mount has a body part (1) carrying guides (2) and a movable part (3), which holds an electrode head, movable along the guides. Motion is controlled by a drive consisting of a reversible rotary stepping motor (11), a reduction gearing (13) and a lead screw (16) engaging a nut (18) on the movable part (3). A helical compression spring (20), between the body (1) and movable part (3), removes backlash.

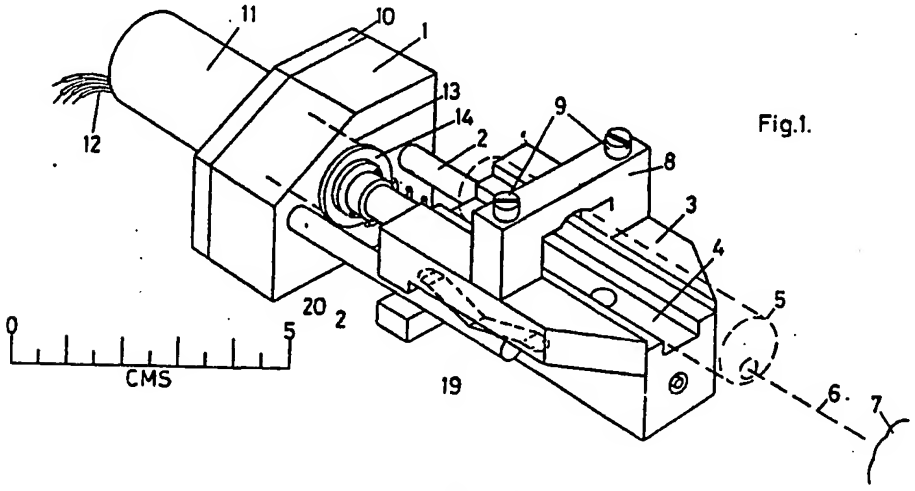
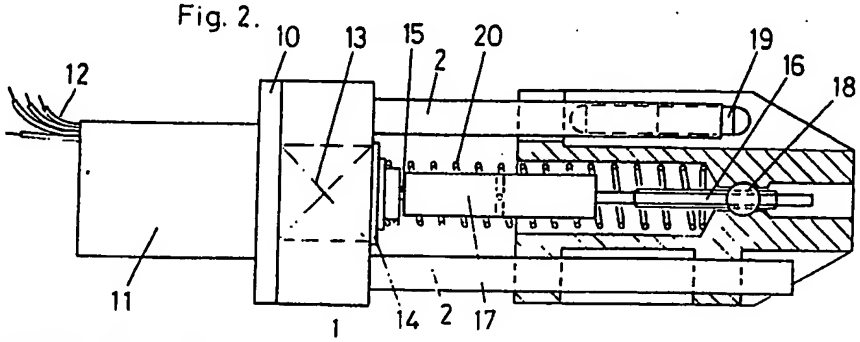


Fig.1.

Fig. 2.



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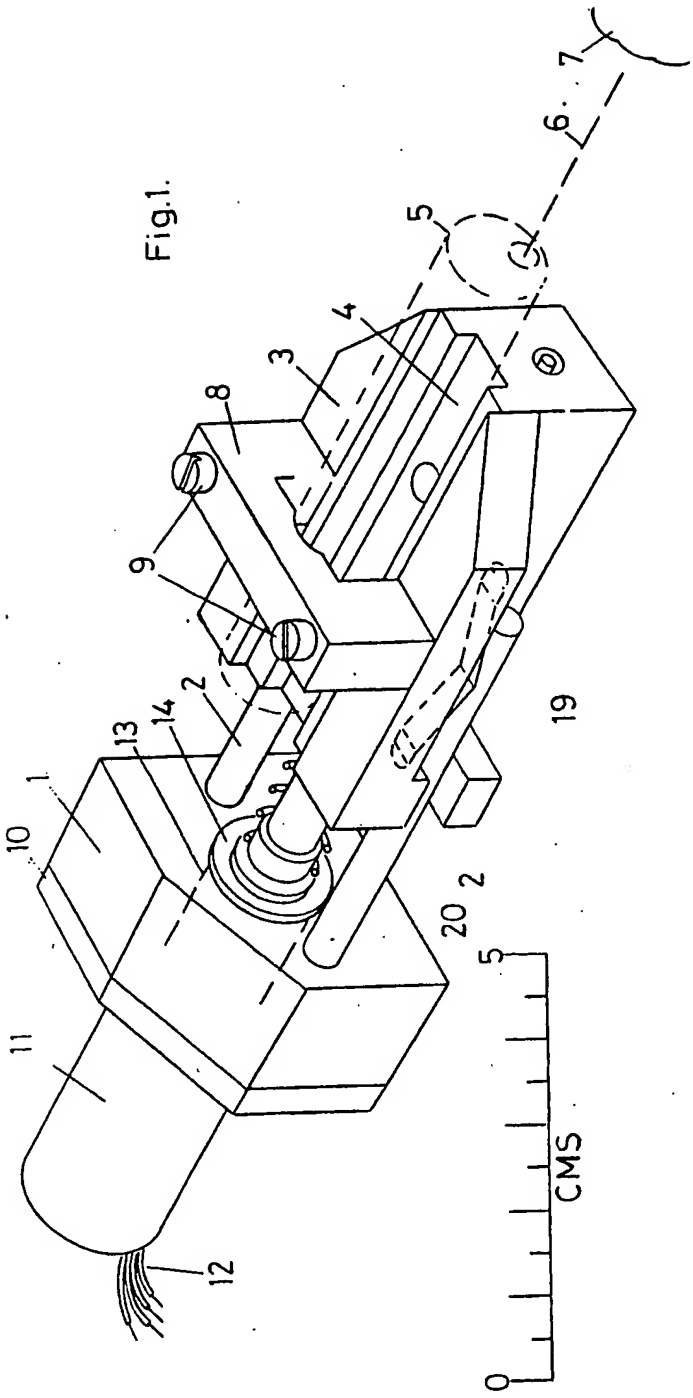
The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1982.

Fig.1.



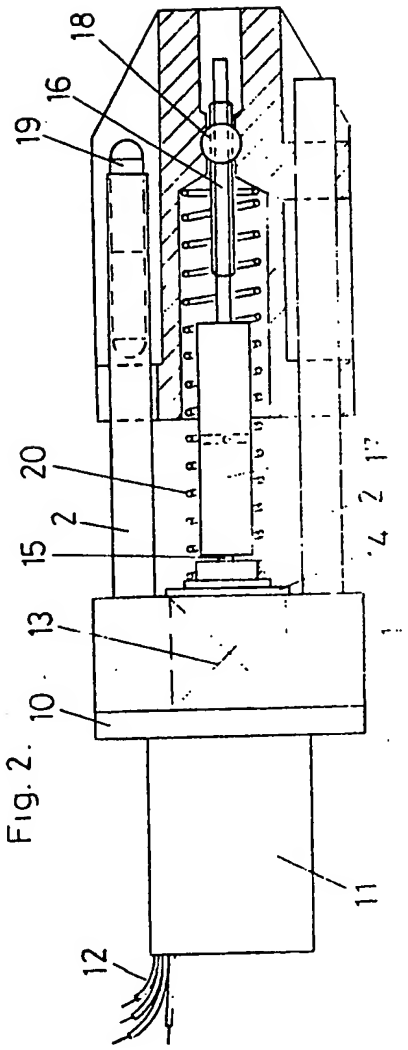


Fig. 2.

SPECIFICATION

Improvements in or relating to adjustable electrode mounts

This invention relates to adjustable electrode mounts such as are used in biological measurements for the precise positioning of an electrode in relation to a cell. The adjustable mount of the invention is adapted to support an electrode head with protruding electrode, together with a head amplifier if required, and is constructed so as to move the electrode longitudinally forwards or backwards. The adjustable mount is itself carried and positioned by a three-axis manipulator. However, such manipulator and electrode head do not form part of the present invention per se.

The object of the invention is to provide an adjustable electrode mount able to carry an electrode head and to move the electrode in small and exact incremental steps which are capable of being accurately defined and repeated.

Accordingly, the invention provides an adjustable electrode mount of the type stated above, having a relatively fixed body part carrying a plurality of guide members, a relatively movable body part supported laterally by said guide members and having fixing means for securing an electrode head thereto, with the electrode extending parallel to said guide members, a rotary stepping motor carried on said relatively fixed body part and driving a speed-reduction gearing, a leadscrew driven through said speed-reduction gearing engaging a nut carried by said relatively movable body part for the purpose of moving said relatively movable body part longitudinally and a helical spring abutting said fixed and movable body parts, for removing backlash therebetween.

Short Description of the Drawings

One embodiment of the invention will now be described in detail, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is an isometric view from the front and above of an adjustable electrode mount according to the invention, and

Figure 2 is a view of the adjustable mount of Fig. 1 from the underside thereof, the movable body part being cut away in the plane of the leadscrew.

Description of the Example

The adjustable electrode mount shown in the accompanying drawings has a relatively fixed body part 1, from which extend forwardly a pair of guide bars 2, upon which slides a relatively movable body part 3. The body part 3 is restrained against lateral movement and against rotational movement by the guide bars 2, but is free for longitudinal movement parallel to the guide bars 2.

The body part 3 has a stepwise cut-away channel 4 to receive the body of a cylindrical electrode head and head-amplifier. Such an electrode head and head-amplifier is indicated in Fig. 1 in broken lines at 5. The actual electrode is indicated in broken lines at 6. A specimen into which the electrode 6 is to be advanced is shown at 7. A mounting saddle 8 with attachment screws 9 secures the electrode head body 5 to the movable body 3, so that the electrode 6 extends forward of the body 3, parallel to the guide bars 2.

Attached to the body part 1 by a face-plate 10 is a high-speed, rotational electrical stepping-motor 11. Electrical power supply and control leads are shown at 12. The drive shaft of the motor 11, not visible in the views of Figs. 1 and 2, drives a speed-reduction gearing 13, shown in broken lines in both the views of Figs. 1 and 2. The output shaft bushing 14 of the gearing 13 projects forwards of the body 1, as may be seen in both views of Figs. 1 and Fig. 2.

The low-speed output drive shaft 15, a short length of which may be seen in the view of Fig. 2, drives a lead screw 16 through an intermediate "Hooke's" type coupling 17. The lead screw 16 engages a nut 18 held in the body part 3 and advances and retracts the body part 3 along the guide bars 2, depending upon the sense of rotation of the stepping-motor 11, in incremental steps.

The distance of electrode advance per motor step is given by the expression:

Leadscrew Pitch/(Gearing Ratio × Motor Step). The stepping motor 11 shaft rotates in $\frac{1}{4}$ revolution steps and the gearing 13 ratio and lead screw 16 pitch are such that each motor step corresponds to an electrode advance, or retraction, of two microns.

Any backlash due to the lead screw 16 and nut 18 combination and the gearing 13 output shaft, is taken up by a helical compression spring 20, one end of which bears against the gearing bush 14 and the other end of which bears on the body part 3. Any lateral force upon the body part 3, due to eccentricity in the lead screw 16, is minimised by the "Hooke's" type coupling 17. Any radial movement of the body part 3 is restricted by a leaf spring 19, which bears on one guide bar 2 and upon an underside surface of the body part 3. In consequence a very narrow hysteresis curve for forward motion, reverse motion and repeated forward motion is obtained. Backlash is typically one 2 micron step, with two 2 micron steps maximum, over a maximum controlled advance distance, and retraction distance, of 15 millimetres.

In practical application, the adjustable electrode mount is particularly suited for positioning an electrode by computer-generated stepping commands to the stepping motor.

CLAIMS

1. An adjustable electrode mount having a relatively fixed body part carrying a plurality of guide members, a relatively movable body part supported laterally by said guide members and having fixing means for securing an electrode head thereto, with the electrode extending parallel to said guide members, a rotary stepping motor parallel to said guide members, a rotary stepping motor carried on said relatively fixed body part and driving a speed-reduction gearing, a lead-screw driven through said speed-reduction gearing engaging a nut carried by said relatively movable body part for the purpose of moving said relatively movable body part longitudinally and a helical spring abutting said fixed and movable body parts, for removing backlash therebetween.

2. An adjustable electrode mount as claimed in Claim 1, having a pair of spaced-apart parallel guide members carrying the said movable body part and at least one leaf spring bearing both on the movable body and on a guide member, to restrict radial movement therebetween.

3. An adjustable electrode mount as claimed in Claim 1 or Claim 2, in which the said rotary stepping motor directly drives the said speed-reduction gearing.

4. An adjustable electrode mount as claimed in Claim 3, in which the said speed-reduction gearing drives the said lead-screw through a "Hooke's" type coupling.

5. An adjustable electrode mount as claimed in Claim 4, in which the said helical spring abuts a bush in the housing of said speed-reduction gearing, at one end of said spring, extends around said "Hooke's" type coupling, extends in a cylindrical bore formed for part of the length of the said movable body part and abuts the said body part at the other end of said helical spring and at the end of said bore.

6. An adjustable electrode mount as claimed in any one of Claims 1 to 5, in which the said rotary stepping motor rotates in quarter-revolution steps and the pitch of said lead-screw and nut combination is such that the forward, or reverse, movement of said movable body part for each motor step, is of the order of two microns.

7. An adjustable electrode mount as claimed in Claim 1, constructed substantially as described herein with reference to the accompanying drawings.

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